United States
Environmental Protection
Agency

Literature Review for Case Study of the Impact of Stormwater Regulations on Residential Development Patterns in New York State

This literature review is an excerpt from a case study analysis still under review by EPA. The case study examines the relationship between stormwater regulations and sprawl by conducting a retrospective analysis of how an existing post-construction stormwater regulation affected urban sprawl in New York State.

1 Sprawl Literature Review

To provide context and background for the remainder of the report, this section discusses existing literature on sprawl and its determinants. Section 2.1 begins by defining the concept of sprawl. Section 2.2 then discusses literature on the many geographic, socioeconomic, and regulatory factors that have been shown to cause or correlate with sprawl.

1.1 Defining Sprawl

The term "urban sprawl" is a broad concept that generally refers to low-density development. Because it is an umbrella term, there are numerous methods of categorizing and measuring sprawl, not all of which are closely related (Burchfield et al., 2006; Nechyba and Walsh, 2004; Galster et al., 2001). The following bullets describe several common metrics of sprawl.

- The most important indicator of sprawl is *density*: the number of people or housing units per unit of total land area (Sudhira et al., 2003; Chin, 2002). Variation on this metric exist, including whether the denominator is defined in terms of total area, total land area, or total developable land area.
- Another important indicator of sprawl is *spatial disaggregation*: the extent to which development is distributed across a wide area (Galster et al., 2001). For example, a metropolitan area in which development spreads into distant exurbs would have a high degree of spatial disaggregation. In contrast, a metropolitain area in which development is primarily concentrated near a central business district would have a low level of spatial disaggregation.
- Two related indicators include *clustering* and *fragmentation*. Clustering refers to whether development within any particular area is tightly bunched together, occupying little space in a square mile. Fragmentation indicates whether different land uses, such as forests and agricultural land, are separated into many small unconnected patches across the landscape (Chin, 2002).

For the purposes of this case study, EPA chose to define sprawl based on a density metric: the number of residential lots built per total acre of development. This definition is consistent with previous research, and has the important practical advantage of being possible to calculate using the NOI (described in Section 4.1.1).

1.2 Land-use Regulations and Sprawl

Previous research has identified a number of positive and negative consequence of urban sprawl, including the benefits of larger housing lot sizes, and the costs of longer commuting times and habitat fragmentation (Nechyba and Walsh, 2004; Wassmer, 2005; Chin, 2002). Regardless of whether or not the benefits of sprawl outweigh its costs, it is important to understand how policy decisions—such as promulgating stormwater regulations—could affect sprawl.

To provide background for this case study, EPA reviewed the existing literature relevant to predicting how stormwater regulations are likely to affect sprawl. According to EcoNorthwest (2011), the relationship between stormwater regulations and urban sprawl has not been well studied. Consistent with this, EPA identified only one quantitative study—Sung (2013)—that explicitly considered how stormwater policies affect sprawl. This study evaluated the effects that an impervious surface regulation had on development patterns near Austin, TX, by comparing the change in land use patterns following

implemtnation of the regulation, relative to the change in land use patterns in nearby unregulated areas. The study found that the impervious surface regulation encouraged urban sprawl by dispersing development to an urban fringe, reducing infill, and increasing forest fragmentation.

In addition to searching for literature on stormwater regulations and sprawl, EPA also investigated the broader literature on other determinants of sprawl. Recent research shows that there are many factors that can affect sprawl, including:

- *Geographic factors*, such as the absence of mountains, the presence of hills or rugged terrain, the presence of aquifers, a temperate climate, the presence of existing undeveloped land outside the municipality, and the presence of a coast (Burchfield, 2006);
- *Historical urban design characteristics*, such as the absence of a central business district, or the absence and quality of mass transportation (Burchfield, 2006; Wassmer, 2005); and
- *Local taxation and zoning policies*, such as minimum lot size regulations (Brueckner and Kim, 2003; Knapp et al., 2000).

Studies of land use regulation and zoning are particularly relevant to EPA's efforts to understand the impacts that stormwater regulations could have on urban sprawl. Studies generally find that more stringent zoning requirements results in lower urban densities, either by requiring new developments to meet low density restrictions, or by protecting existing low-density development from further changes (Knapp et al., 2000).